

ORIGINATING TECHNOLOGY/ NASA CONTRIBUTION

In the 1960s, NASA civil servant Tom Hughes worked for Marshall Space Flight Center's Quality Control Laboratory as a systems engineer. Reporting directly to Dr. Wernher von Braun, Marshall's first director, Hughes was assigned as a NASA representative for quality control at the Michoud Assembly Facility in New Orleans, Louisiana, to oversee the Saturn V rocket project. During this time, Hughes invented several technologies to improve the safety of the rocket, earning several commendations from von Braun. He also gained technical expertise in microwave technology, as NASA researched it to determine its relationship to radar.

As Hughes read and studied NASA's microwave reports, his job requirements also led him to gain experience in packaging materials. NASA sent Hughes to the School of Military Packaging Materials at Aberdeen Proving Ground, in Maryland, which trained NASA personnel as well as military personnel. At the school, Hughes discovered heat-sealing packaging materials that were developed for NASA applications. This type of material eventually became an element of Hughes' invention, a heating and cooling pad that utilizes a thermal ceramic compound.

PARTNERSHIP

The microwave expertise Hughes gained during his employment with NASA led him to develop the unique thermal ceramic compound. Drawing upon NASA's research studies, Hughes experimented with various clay materials to determine which were microwave-reactive, meaning they would absorb heat, and which were microwave-invisible, meaning the microwaves have no affect. Before long, Hughes developed the soft and pliable ceramic material, which is capable of absorbing heat through microwaves and retaining it for an extended period of time. The clay-based substance also retains the cold when placed in the freezer.



The pack containing the Thermal Ceramix® material for the ThermiPaq™ is enclosed in a soft, washable cover.

PRODUCT OUTCOME

After patenting the material as Thermal Ceramix,® Hughes joined with four partners to form [Thermionics Corporation](#), and worked to bring the technology to the commercial market. Originally based at Clemson University's Center for Applied Technology, the company is now located in Springfield, Illinois.

Thermionics' products incorporate the Thermal Ceramix's ability to retain heat and coldness and release them slowly at a stable temperature over several hours. The company's most prominent product is the ThermiPaq,™ a therapeutic pad that provides hot and cold therapy for pain caused by ailments such as arthritis, muscle pain, swelling, sunburn, sinus headaches, cramps, and sprains. Within the ThermiPaq, the Thermal Ceramix compound is contained

in the heat-sealing packaging material that Hughes learned about at the School of Military Packaging Materials. The reusable pad cools in the freezer and heats in the microwave, while maintaining its flexibility at any temperature. This flexibility allows the ThermiPaq to conform to the affected area of the body. The product incorporates a soft, washable cover, as well as a VELCRO® strap to hold the pad in place on the sore area.

For hot therapy, users heat the ThermiPaq in the microwave for a few minutes as detailed in the instruction manual. For cold therapy, the pad is ready after being placed in the freezer for an hour. The ThermiPaq retains its therapeutic temperature for 30 minutes, and then remains at a comfortable hot or cold level for an additional hour and a half. The Thermal Ceramix material within the pad is environmentally safe and nontoxic, and is easy to use without any electrical cords, messy gels, or hot water bottles and ice bags to fill.

The Thermal Ceramix technology in ThermiPaq capitalizes on the efficiency of radiant energy, offering distinct advantages over the convective energy used in gel/liquid-based products. While convective energy transfers immediately, leading to rapid temperature loss and the potential for hot spots, radiant energy is transferred slowly and evenly, allowing the ThermiPaq to penetrate deeply and more effectively. Also, unlike products that incorporate gels or chemical liquids, the ThermiPaq does not need to be rejuvenated by boiling it or soaking it in water.

Thermionics' product line also includes the Wine Tote,™ which incorporates the Thermal Ceramix technology to chill and safely transport up to three bottles of wine. The tote's reusable chill pack can be stored in the freezer and then slipped in between the bottles of wine to keep them cold. Another product, Quick Chill,™ is a bottle wrap that is cooled in the freezer and then placed around a beverage bottle, chilling it in 10 minutes and keeping it cold for up to 3 hours. The wrap's VELCRO closure adjusts to most bottles, making it perfect for soda, water, wine, and other beverages.



The ThermiPaq™ provides hot and cold therapy for pain caused by ailments such as arthritis, muscle pain, swelling, and sprains.

Another Thermionics product is Teddy WarmHeart,® a special stuffed bear that radiates a gentle warmth from his own thermal ceramic “heart.” Originally developed for hospital use, the toy bear comes complete with a “hibernation” sleeping bag. After taking a short, 1 minute nap in the microwave, Teddy WarmHeart emerges ready to share his warmth with children of all ages. Remaining warm for up to 4 hours, the bear is soft, hypo-allergenic, and does not require any batteries or wires.

Thermionics' products are available in retail stores, pharmacies, and through the company's Web site. The ThermiPaq recently became available through select Wal-Mart stores.

Thermal Ceramix® and Teddy WarmHeart® are registered trademarks of Thermionics Corporation.

ThermiPaq,™ Wine Tote,™ and Quick Chill™ are trademarks of Thermionics Corporation.

VELCRO® is a registered trademark of Velcro Industries B.V.